The Impact of Persuasive Messages on the Disclosure of Personal Health Information

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Abstract

Individuals' disclosure of personal health information (PHI) holds substantial benefits for providers, but users are often reluctant to disclose. While providers can employ persuasive messages, little is known about their effects in the sensitive context of PHI disclosure. To address this research gap, we conduct a web-based experiment with 529 non-users of health wearables (HWs) to examine the influences of persuasive messages (attribute framing and argument strength) on individuals' PHI disclosure. We reveal that individuals tend to disclose more PHI when they experience persuasive messages with more positively framed HW attributes or messages with higher argument strength concerning data collection. We enable researchers to uncover the impact of persuasive messages in highly sensitive data environments and provide practitioners with workable suggestions to have individuals disclose more PHI.

1. Introduction

Personal health information (PHI) is a protected and unique resource that holds substantial benefits for users, caregivers, and healthcare institutions. Novel health information technologies (health ITs), such as health wearables (HWs), automatically collect PHI and give individuals direct access to it, which can contribute to their health, facilitate preventive care, and support the management of ongoing illnesses [13]. Increasing PHI can help HW providers to make better decisions in their marketing campaigns, including forecasting, statistical analyses, program planning, evaluation, and transformation of business models and IT strategies [4, 44]. However, all these potential business advantages depend on individuals' PHI disclosure. As studies indicate continuous reluctance (i.e. 55% of Europe's population is willing to disclose PHI to physicians, but only 7% to HW providers [32]), the question is: how can HW providers influence individuals' willingness to disclose more PHI?

According to privacy calculus theory, individuals are willing to voluntarily share personal data if they expect that the perceived value from data disclosure will outweigh the perceived costs [37, 46]. The research suggests that persuasive messages, and not just the content of the product or the privacy policy, may affect individuals' propensity to disclose PHI [1, 39]. Thus, HW providers could use persuasive messages to influence individuals' tradeoff decisions without changing the product or service, which would result in increased costs. Persuasive messages are applied in designing implicit cues in product presentations to influence attitudes and practices [42]. Online descriptions of HWs fall into two blocks: the product description and the privacy policy statement concerning the data disclosure. Hence, providers can manipulate, first, the description of the device and, second, the privacy policy statement. For the former, the attributes of HWs can be presented in different frames (attribute framing). Framing refers to the phenomenon whereby "simple and unspectacular changes" in product presentation lead to changes in choice [23, p. 205]. For the latter, the privacy policy statement can be influenced by different argument qualities and quantities of data collection (argument strength). The research shows that the argumentation in privacy-relevant information interacts with the effect of changes in the objective privacy risk as a result of disclosure, and individuals' propensity to disclose personal information. While it can be assumed that attribute framing would increase individuals' perceived benefits and that argument strength would decrease perceived risks [39], both attribute framing and argument strength have barely been evaluated [23, 40]. In the few existing cases, they were mostly examined in combination with personality traits such as self-esteem, perceived prestige, and information sensitivity. Also, they have mostly been investigated in non-health-related contexts, whereas the multidimensional effect of the combination of the two factors on PHI disclosure has

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not yet been examined [30]. We respond to the call for research [5] to identify new predictors of persuasion in the context of health ITs by investigating individuals' PHI disclosure, to "help researchers and designers understand the major dimensions that are critical in their work" [3, p. 497]. We ask:

RQ: How do persuasive messages influence individuals' PHI disclosure?

To answer this research question, we conducted a web-based experiment with 529 non-users of HWs to analyze the influences of persuasive messages (attribute framing and argument strength) on individuals' PHI disclosure. By varying attribute framing and argument strength in a 3x3 experimental setting, we reveal that individuals tend to disclose more PHI when they experience persuasive messages with more positively framed HW attributes and messages with higher argument strength concerning data collection. We provide researchers with an overview of individuals' information processing of persuasive communication concerning PHI disclosure and enable practitioners (HW providers and health policy makers) to foster health IT usage programs based on incentives or special privacy communication strategies to increase individuals' PHI disclosure.

2. Theoretical background

2.1. Personal health information disclosure

The impact of persuasive messages on the disclosure of PHI depends on an individual's cost-benefit analysis, which is defined as their assessment of perceived risks and benefits. According to privacy calculus theory, individuals measure the tradeoff between the usage and the potential negative outcomes of sharing PHI. Thus, individuals are willing to voluntarily disclose PHI if they expect that the perceived value of data disclosure will outweigh the perceived risks [46].

However, not all information is considered equally sensitive or private by individuals, so the information type they are asked to disclose impacts on their perceptions, processing, and behaviors. Individuals are more willing to provide certain information types about themselves compared to other information they perceive as more sensitive. They evaluate information about themselves and consider the information to have different sensitivity levels, which affects individuals' risk perceptions [34]. Furthermore, individuals are more willing to provide demographic and lifestyle information to marketers compared to health information or personal identifiers such as name, address, and social security number. Requests for more sensitive information reduce trust beliefs and intentions to disclose, increasing risk perceptions [33].

Individuals generally want control over their information and awareness of the information types collected about them. It is easier for them to trust organizations if they understand which information type is gathered, the way in which it is collected, and that the user can manage the way information is treated in privacy policies [8]. But, since PHI was found to be the most sensitive information type, as other studies have shown, even serious privacy policies did not mitigate individuals' privacy risk perceptions. It is argued that when requested information is very sensitive, the information's context and relevance become more important as the user determines whether to disclose correct information. Anderson and Agarwal [4] compared the sensitivity and the disclosure of PHI and the different PHI types (general health, mental health, and genetic information) and found that the requested PHI type had no significant impact on the privacy perceptions or the trust in the technology used for a transaction. In turn, this meant that the requested PHI type did not impact individuals' willingness to disclose PHI. Thus, all PHI types are sensitive for individuals, and individuals don't distinguish between the different PHI types [4, 34].

2.2. Persuasive communication

According to the definition of Stiff and Mongeau [42], any message that has the purpose of influencing an individual's intentional behavior is referred to as persuasive communication. Through conformity effects such as compliance or identification, online persuasion has become increasingly important owing to the digital age and social media. However, there has been little research into online persuasion. To date, it has mainly been used for product advertising and health communication messages [42]. Most studies have focused on information disclosure regarding e-commerce transactions, use of online services and social network sites, and technology acceptance [e.g. 7].

Focusing on studies that specifically analyzed decision-making and persuasive communication in the health context, we identified three research streams. The first analyzes sharing behaviors concerning personal health record data with clinicians and public health entities [45]. The second stream examines individual factors that influence the adoption of health technologies, treatments, and disclosures. The third research stream measures the

influence of perceived risks and benefits on behavioral intentions and framing concepts to enhance benefits concerning health decisions [6, 16]. An overview of exemplary studies and related theories appears in Table 1.

Table 1. Exemplary studies on persuasive communication and PHI disclosure

Research stream	References	Research topic	Theory
Sharing medical data	[e.g. 5, 45, 47]	Sharing personal health record data with clinicians and public health entities	Elaboration likelihood model (ELM)
Health IT adoption	[e.g. 2, 4, 22, 30, 43]	Adapting technologies, treatments, and disclosures	ELM, coping theory, coping model of user adoption, privacy calculus
Health frames	[e.g. 6, 16, 17, 19]	Framing effects on health decisions	Prospect theory, framing

2.3. Attribute framing and argument strength as persuasive messages

Persuasive communication can be presented as video or audio or in written modes, live, in person, or online. Figure 1 shows our theoretical framework of persuasive communication concerning PHI disclosure. Besides other persuasive message predictors for online communication, such as source credibility or fear appeals, we used the two established constructs attribute framing and argument strength [39, 48]. This means that a message's content can be presented in different frames (attribute framing) and different levels of usefulness of the information (argument strength).

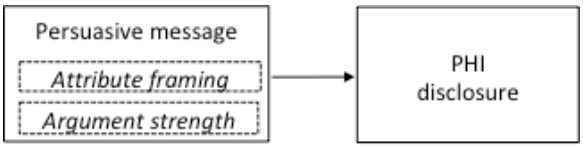

Figure 1. Framework of persuasive communication on PHI disclosure

Attribute framing: Concentrating on attitude changes caused by persuasive communication, a well-known influence on individual choices is message framing. Framing exhibits two logically analogous ways to present identical information. It refers to either highlighting benefits and conforming to the message advocacy or to accentuating costs when failing to comply [40]. Two message framing types commonly used in marketing and in health decision-making are goal framing and attribute framing. We concentrate on attribute framing, since the features of HWs can be better described in a positive or negative style than in a goal accomplishment setting. Attribute frames can be based on value, award a financial advantage, or generally deal with gains and losses. Possible framing elements could be urgency, persistence, simplicity, or visuals and metaphors that must be assessed and arranged depending on fit and effectiveness [6]. According to Angst and Agarwal [5], message content is more likely to positively influence behavior if the message frame leads to positive thoughts and associations. Thus, message frames that lead to predominantly negative thoughts may not anticipate substantial changes in an individual's attitude or behavior. Block and Keller [12] assessed frames' effects on different topics and found that positive message framing is more likely to lead to the expected behavior relating to for instance public service campaigns, but negative message framing is more likely to lead to the anticipated behavior regarding health studies. This implies that both negative and positive message framing influence behavioral outcomes, but the effect differs depending on the issue [12, 41]. In an attribute frame context, positive frames are more effective than negative ones. Frames can be implemented by presenting either desirable vs. undesirable attributes or the presence vs. absence of (un)desirable attributes. This effect has been replicated in many studies, including product evaluations and medical treatments [28, 29].

Argument strength: An argument's message includes information, which has two components: Information quality and information quantity. Information quality is defined as "[…] the usefulness of the available attribute information in aiding a decision maker to evaluate his/her true utility associated with an alternative", while information quantity is described "[…] as the number of items or attributes describing an alternative" [20, p. 200]. When holding quantity fixed, an increase in quality leads to greater confidence in an individual's decision-making. Likewise, when holding quality fixed, an increase in quantity somewhat negatively impacts on an individual's confidence [22]. The combination of the two is called argument strength; it strongly influences arguments' persuasiveness, impacting on an individual's attitude and behavior. Argument strength relates to the information's

usefulness. Strong arguments are perceived as more convincing than weak or no arguments [14].

3. Research model

Descriptions of HWs fall into two blocks: the product description and the privacy policy statement concerning the data disclosure. By using persuasive messages, we assume that HW providers can manipulate these two blocks and can influence individuals' risk-benefit-tradeoff perceptions to disclose more PHI from the users. Since individuals are willing to voluntarily disclose PHI if they expect that the perceived value of data disclosure will outweigh the perceived risks [46], attribute framing should increase individuals' perceived benefits, and argument strength should decrease perceived risks [39]. Thus, we tested three effects on PHI disclosure: (H1) the effect of framing HW attributes, (H2) the influence of argument strength concerning data collection, and (H3) the interplay between frame and argument effects by varying the two factors.

3.1. Attribute framing

Positive frames have a superior effect on attitude change when they promote a product or its benefits [22]. Research shows that a mere framing of choices (in terms of gains and losses) significantly impacted on individuals' decisions. Labeling ground beef as *75% lean* instead of *25% fat* significantly impacted on participants' perceptions of the beef's quality [28]. Thus, a message's content is more likely to positively impact on behavior if the message frame causes positive thoughts and associations [5]. In contrast, message frames that lead to mainly negative thoughts may not anticipate considerable changes in an individual's behavior. Positively framed product descriptions may decrease negative thoughts about possible risk concerning PHI disclosure. When attribute framing is applied, the product depicts the object of the frame and arguments for the product usage are the object's attributes, which impact on the decision [22]. We hypothesize:

H1: Individuals who experience persuasive messages with more positively framed HW attributes tend to disclose more PHI.

3.2. Argument strength

Argument strength is directed at individuals' rational judgment rather than the effect by reinforcing or improving their beliefs [11]. Individuals who are influenced by strong arguments are likely to hold a strong, accessible attitude to the information. They engage in thorough cognitive activity, assessing the information presented and thinking about it. It is reported that individuals produce more favorable responses to messages with strong than weak arguments [35]. When a message can be scrutinized carefully, an individual will likely have more thoughts or arguments [31]. Nonetheless, a disputable view on argument strength can be discovered in Langer, Blank and Chanowitz [26] experiment. Participants were confronted with either real or placebic information, i.e. the argument is either logical or illogical. Despite the fact that, for logical arguments, individuals perceive higher argument strength levels than for illogical or no arguments, the study uncovered another interesting aspect. It revealed that inquiries led to a positive outcome significantly more often if some reasoning was included in the inquiry, whereas the argument's quality was unimportant. We hypothesize:

H2: Individuals who experience persuasive messages with higher argument strength levels tend to disclose more PHI.

3.3. The interaction effects of attribute framing and argument strength

Individuals rationally assess attribute framing and argument strength at once, since both components appear in one message that refers to the same product [6]. Thus, perceived risks and benefits are influenced by the attribute frame (gain-oriented or loss-oriented) and the argument strength (strong or weak) [20, 40]. Since attribute framing should increase perceived benefits, and argument strength should decrease perceived risks, it can be assumed that the effect on the PHI disclosure is stronger than if only one construct is applied to the message. Adapting only one construct implies that either perceived benefits are enhanced, or perceived risks are reduced, which results in a smaller tradeoff between risks and benefits. We hypothesize:

H3: The joint use of attribute framing and argument strengths elicits higher PHI disclosure than each of the two mechanisms alone.

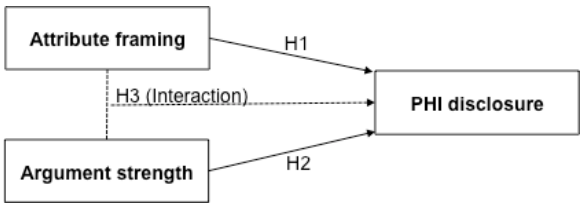

Figure 2. Research model

4. Methodology

4.1. Data collection

We performed an expert panel and a pilot test to validate the messages and instruments prior to the final data collection. We made minor changes to the survey instructions and to certain items' wordings. We then conducted the final web-based experiment in February 2018 using Qualtrics. We included time stamps to record the time a participant spent on every survey page. We excluded unrealistic responses from the analyses. We collected 605 responses from non-users of HWs; however, the final sample size was 529 after the responses were screened, based on the timestamps and deleting the incomplete survey responses. The participant ages ranged from 18 to 78, with a mean of 29.1 years (SD = 10.28); 54.6% were male and 45.4% were female. Two-thirds of the participants (68.1%) had at least a two-year college degree or higher; 65.6% were employees or self-employed, and 31.4% were students.

Table 2. Sample

Demographics	Frequency	Percentage
Gender		
Male	289	54.6%
Female	240	45.4%
Age		
< 22	149	28.2%
23 to 25	132	24.9%
26 to 30	91	17.2%
31 to 40	80	15.1%
> 41	77	14.5%
Education level		
None	16	3.0%
High/Secondary school	136	25.7%
Bachelor	170	32.2%
Master's/Diploma/Magister	182	34.4%
PhD	25	1.5%
Employment status		
Employed	271	51.2%
Self-employed	76	14.4%
Student	166	31.4%
Unemployed	16	3.0%

4.2. Experimental design

Since HWs are very diverse, we had to create a similar product and provider vision by concentrating on a specific subgroup of the examined technology. We used the Fitbit charge 2 from the provider Fitbit, one of the most used HWs [27]. We used the original website of Fitbit charge 2 and replaced its HW attributes and arguments for data collection with our treatments (Appendix). Thus, we guaranteed both sufficient knowledge about the provider and subject, as well as an intuitive and natural environment for the treatments. After this product presentation as an official product website, the participants received the survey and had to answer attention check questions to ensure that they had paid attention to the product website. Participants who failed to answer the attention check question were not allowed to continue the survey. The participants were then randomly split into nine treatment groups (see Table 2).

Table 3. 3x3 factorial design

		Attribute framing		
		Loss-oriented framing (LOF)	Neutral framing (NF)	Gain-oriented framing (GOF)
Argument strength	Logical arguments (LAG)	*Group 1 (n = 66)*	*Group 4 (n = 57*	*Group 7 (n= 68)*
	Illogical arguments (IAG)	*Group 2 (n = 46)*	*Group 5 (n = 75)*	*Group 8 (n = 60)*
	No arguments (NAG)	*Group 3 (n = 57)*	*Group 6 (n = 54)*	*Group 9 (n = 46)*

The treatment (persuasive message) consisted of a loss-oriented, neutral, or gain-oriented framed HW attribute description and a privacy policy statement with logical, illogical, or no arguments for data collection. We adapted the treatments from Raj, Charles and Alisha [38] and modified them to fit the context (Appendix). After two manipulation checks to assess perceived quality and quantity, we measured the individuals' PHI disclosure using Malhotra, Kim and Agarwal's [33] multi-item scale along a seven-point Likert scale. We then recorded demographics such as gender, age, employment, and education.

To verify that our manipulation was successful, (i.e. showed a notable difference in the perception of the framing level), we used the manipulation check questions of Petty, Cacioppo and Schumann [36]. The manipulation check for attribute framing, using ANOVA ($F = 31{,}221$, $p < 0.001$; $M_{Average} = 2.74$) and the Bonferroni test, showed that the three descriptions of the HW attributes were perceived differently, depending on the framing levels. Gain-oriented framing ($M_{GOF} = 3.59$; $p < 0.001$) revealed a significantly higher value than neutral framing ($M_{NF} = 2.60$; $p < 0.001$) and loss-oriented framing ($M_{GOF} = 2.02$; $p < 0.001$). Thus, the effectiveness of the implementation of the three framing levels was supported.

We used the nine manipulation check questions of Zhao, Strasser, Cappella, Lerman and Fishbein [48] for argument strength. The ANOVA ($F = 43{,}951$, $p < 0.001$; $M_{Average} = 3.58$) and the Bonferroni test

showed that the three arguments' strengths were perceived differently. Logical arguments (M_{LAG} = 4.38; $p < 0.001$) revealed a significantly higher perceived strength than the descriptions with illogical (M_{IAG} = 3,43; $p < 0.001$) and no arguments (M_{NAG} = 2.79; $p < 0.01$). Thus, the effectiveness of the implementation of the three argument levels was supported.

5. Results

We conducted a two-way ANOVA and individual mean comparisons using the Bonferroni test, since the assumptions for both methods were true. The different groups can be considered independent, since the subjects are randomly assigned.

We conducted a Kolmogorov-Smirnov test on the collected samples. The p-value (0.42) assumed a normal distribution for the dependent variable PHI disclosure. Also, we used the Levenes test and obtained an F-value of 1.951 and a p-value of 0.51, failing to reject the equal variance dispersion hypothesis.

First, we used a two-way ANOVA to identify the main effects and interaction effects. Table 4 shows the analysis results. To examine H1 and H2 more closely, we conducted the mean comparisons among multiple groups using the Bonferroni test, which is considered suitable for such analyses [21].

Table 4. Results of the two-way ANOVA

Treatment (hypothesis)	F	Sign.
Attribute framing (H1)	11.833	**< 0.001**
Argument strength (H2)	39.287	**< 0.001**
Attribute framing x argument strength (H3)	1.039	0.386

From the F-statistic, we found that attribute framing's main effect reached a significant level (F = 11.833, $p < 0.001$). Concerning the framed HW attributes (H1), individuals distinguished between all three framing levels. The contrasts for loss-oriented vs. neutral ($p < 0.05$), neutral vs. gain-oriented ($p < 0.01$), and gain-oriented vs. loss-oriented ($p < 0.001$) were significant.

As Table 5 shows, and as hypothesized in H1, a more positive framing level increased individuals' PHI disclosure. Loss-oriented framing (MS_{LOF} = -0.73, SD = 0.14) had a smaller mean value than neutral framing (MS_{NF} = -0.21, SD_{NF} = 0.13) and gain-oriented framing (MS_{GOF} = 0.26, SD_{NF} = 0.14). Thus, H1 was supported.

Table 5. Bonferroni group comparisons of attribute framing on PHI disclosure (H1)

Group A	Group B	Mean difference (A - B)	Sign.
Loss-oriented *mean: -0.73, SD: 0.14*	Neutral *mean: -0.21, SD: 0.13*	-0.49	**< 0.05**
Neutral *mean: -0.21, SD: 0.13*	Gain-oriented *mean: 0.26, SD: 0.14*	-0.57	**< 0.01**
Gain-oriented *mean: 0.26, SD: 0.14*	Loss-oriented *mean: -0.73, SD: 0.14*	1.08	**< 0.001**

The main effect on PHI disclosure that arose from different arguments was significant (see Table 5) (F = 39.287, $p < 0.001$). Concerning the arguments for data collection (H2), individuals distinguished between all three levels. The contrasts for illogical vs. no arguments ($p < 0.001$), no vs. logical arguments ($p < 0.001$), and logical vs. illogical arguments ($p < 0.01$) were significant (Table 7). Persuasive messages with higher argument strength tended to lead to higher PHI disclosure. H2 was supported. Table 8 shows that persuasive messages containing arguments for data collection (even illogical (MS_{IAG} = -0.08; SD_{IAG} 0.14)) elicit higher PHI disclosure than persuasive messages without arguments (MS_{NAG} -1.21; SD_{NAG} 0.14).

Table 6. Bonferroni group comparisons of argument strength on PHI disclosure (H2)

Group A	Group B	Mean difference (A - B)	Sign.
Illogical arguments *mean: -0.08, SD: 0.14*	No arguments *mean: -1.12, SD: 0.14*	0.83	**< 0.001**
No argument *mean: -1.12, SD: 0.14*	Logical arguments *mean: 0.58, SD: 0.13*	-0.55	**< 0.001**
Logical arguments *mean: 0.58, SD: 0.13*	Illogical arguments *mean: -0.08, SD: 0.14*	0.61	**< 0.01**

H3: The interaction effect between attribute framing and argument strength was insignificant (F = 1.039, $p > 0.05$). We had to reject the hypothesized interaction effect between attribute framing and argument strength; thus, H3 was not supported.

6. Discussion

Motivated by the question how HW providers can influence individuals' willingness to disclose more PHI, we conducted a web-based experiment with 529 non-users of HW to examine the influences of

persuasive messages (attribute framing and argument strength) on individuals' PHI disclosure. We tested three effects on PHI disclosure: (H1) the effect of framing HW attributes, (H2) the influence of argument strength concerning data collection, and (H3) the interplay between the two factors. By varying attribute framing (loss-oriented, neutral, gain-oriented) and argument strength (logical, illogical, no arguments) in a 3x3 factorial design, we found support for H1 and H2, and had to reject H3. Figure 3 sums up our results, which we will now discuss in some detail:

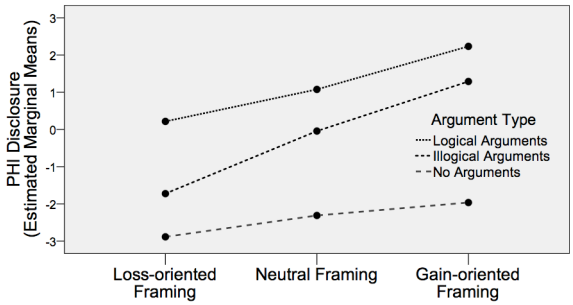

Figure 3. Impact of persuasive messages on PHI disclosure

Attribute framing (H1): Our results showed that individuals who experience persuasive messages with more positively framed HW attributes tend to disclose more PHI. Valence-based associative processing is probably a valid explanation of how attribute framing affected the content of individuals' PHI disclosure behaviors, and thus why gain-oriented framing led to more positive evaluations of the HW attributes than negative HW attribute framing. Prior research usually investigated evaluation effects of labeling a key attribute in positive vs. negative terms without questioning differences in susceptibility to framing effects [e.g. 17]. By including a neutral frame, we were able to examine the magnitude of framing effects and found that participants who received positive framing were more affected by attribute framing than those who received negative framing. This indicates that when individuals experience gain-framed HW attributes, it will probably outweigh the perceived risks of data collection; thus, they are more inclined to take risks and disclose more PHI. This finding is also consistent with the position that more effortful and less heuristic processing may reduce susceptibility to cognitive biases [24]. Since our scenario contained complex and abstract information than is usually the case in attribute framing research, it can be assumed that in such a research context, individuals use more effortful processing. They may have been better able to counterbalance the framing information with other and more relevant information than those using comparably less effortful processing. Thus, for complex decisions such as outweighing the PHI disclosure concerning the perceived risks and benefits, a facilitating effect of more detailed processing should be more likely than an inhibiting or biasing effect [35].

Argument strength (H2): Our results revealed that individuals who experience persuasive messages with higher argument strength tend to disclose more PHI. Persuasive messages containing logical arguments for data collection elicit higher PHI disclosure than persuasive messages with illogical or no arguments. Interestingly (also illustrated in Figure 3), persuasive messages that contain illogical arguments for data collection received higher PHI disclosure than persuasive messages without arguments. However, this is in line with other studies, where it is called placebic information [e.g. 26]. In terms of theory of controlled mindless behavior [25], it can be argued that implementing illogical information concerning data collection is more effective than giving no information, since individuals don't read privacy policies carefully. A recent study showed that 25% never read or directly agreed to privacy policy statements [15]. According to Langer [25], arguments can either be processed in a controlled mindless way or an automatic mindful way. Mindlessness occurs when an individual does not pay attention to new, relevant information. In our case, if the reason given appears to be irrelevant, the arguments for data collection are not examined and evaluated by individuals. Thus, we can state that the context dependency is ignored, and the argument concerning PHI disclosure is processed mindlessly. This means that individuals will automatically and mindlessly process the arguments and will ignore the context dependency.

Attribute framing x argument strength (H3). Finally, as our ANOVA analysis showed no significant effect, we found no interaction of attribute framing and argument strengths. This result stands in contrast to studies in other contexts [e.g. 6]. We can state that in the case of PHI disclosure, adapting only one construct implies that either perceived benefits are enhanced, or perceived risks are reduced, but there is no interaction effect of the two factors that influence individuals' risk-benefit-tradeoff perceptions [46]. However, concerning the effects of attribute framing and argument strength alone, it would be interesting to evaluate the two factors' information processing. According to the elaboration likelihood model, it can be assumed that the framed HW attributes will be processed via the central route

(more conscious and thoughtful), since the information context is complex and interesting to the individuals. In contrast, privacy policy statements and the presented arguments for data collection will probably be processed via the peripheral (less conscious and thoughtful) route, as our results and other research [15] indicated that privacy policies are ignored or not read with care.

7. Implications and limitations

7.1. Implications

From a theoretical perspective, we have responded to the call for researchers [5] to identify new predictors of persuasion in the context on health ITs. We added new insights about the drivers and issues of PHI disclosure. While previous research has dealt with message framing and information quality in a health-related context, factors have been observed separately [12, 40]. To our best knowledge, we are the first to have examined both factors (attribute framing and argument strength) and their interactions concerning PHI disclosure. We have added value to health IT research, since it can be assumed that the explanation lies in the insecurity regarding the technology and HW providers' non-transparent data processing. For this reason, researchers should use information processing models, especially ELM, to clarify the influence of route distinction for persuasive messages in such highly sensitive data environments.

From a practical perspective, our study provides HW providers with implications on how to best influence individuals' intentions to disclose their PHI. Our findings showed how HW providers can have a more efficient data assemblage by adopting the most effective combination of attribute framing and argument strength (e.g. gain-framed HW attributes and logical arguments for data collection) in their product descriptions. Thus, HW providers should concentrate on enhancing consumers' perceived benefits and should reduce their perceived risks. Further, our results may aid health-related organizations with their data collection efforts without changing or adjusting the product and service offering while keeping user gratification and loyalty high. While it is generally accepted that institutional health-related organizations (e.g. hospitals) gather PHI, to date, non-institutional organizations serve only a limited part of the market. Increasing PHI disclosure via persuasive messaging substantially increases a company's market share and sales without affecting costs [10]. By decreasing the perceived risks, a broader customer base could be established, especially among individuals above the age of 40, who have higher concerns about technology and smart devices [9]. Our results advocate how to carefully frame information regarding HW benefits and privacy policies, because a persuasive message strongly affects individuals' attitudes and usage intentions. This is interesting, since political regulation conditions, such as the European general data protection regulation (GDPR) are being implemented in order to increase transparency about data storage, disclosure, and usage [18, 44]. Such reforms are forcing providers to increase their openness. Yet, they should plan their communication strategy wisely so as to reduce predictors of negative attitudes and behaviors. Otherwise, published critical information about data processing leads to more negative attitudes towards technology usage and lower usage intentions.

7.2. Limitations and further research

The survey link was mainly distributed via the Internet. First, the majority of the sample represented a younger population; second, participants had lower privacy concerns than the de facto representative sample owing to having already used and shared information online.

Further, owing to the high sensitivity of PHI, we assumed that PHI disclosure has high personal relevance, implying that participant elaboration had to be high. However, presenting rigid response options may also create *mind blockages*, locking respondents' attention to preconceived answers.

Also, it is important to elaborate whether results differ across different health status, depending on individuals' expectations after engaging with the product and brand. Further, we focused on non-users of HWs and concentrated on a specific HW, to reduce variance of individuals' PHI disclosure concerning different product visions. However, future research should evaluate HW users, as well as other devices, and may distinguish between individuals who use a fitness tracker and the corresponding mobile application and individuals who refuse to use the mobile app but who own a fitness tracker. Also, other constructs that influence the perceived benefits and risks tradeoff should be tested and added to the model, to obtain a valid and complete framework. This is relevant, since research into online persuasion has revealed that personal factors (e.g. the need for cognition, self-esteem, or general privacy concerns) and situational factors (e.g. trust or transparency) affect individuals' privacy concerns and disclosure decisions [e.g. 33, 37, 39].

8. Acknowledgement

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Appendix

	Group	Treatments (adapted from Raj, Charles and Alisha [38])
Attribute framing	Gain-oriented framing (GOF)	The regular use of our fitness tracker **Fitbit charge 2** can help you to improve your spirit and body and to avoid serious diseases: A regular use of fitbit charge 2 will give you important benefits and will reduce your risks. Reduced risk of heart disease by improving blood circulation. Reduced risk of developing high cholesterol. Reduce or maintain body weight or body fat. Obesity is a risk factor for heart disease and can also be a culprit in other diseases. Reduce the inability to build and maintain healthy muscles, bones, and joints.
	Neutral framing (NF)	The regular use of our fitness tracker **Fitbit charge 2** can help you to improve your spirit and body and to avoid serious diseases. A regular use of fitbit charge 2 gives you: A history of your blood circulation. Knowledge of your cholesterol level. Documentation of your body weight and body fat. An understanding of your muscles, bones, and joints.
	Loss-oriented framing (LOF)	The regular use of our fitness tracker **Fitbit charge 2** can help you to improve your spirit and body and to avoid serious diseases. Without a regular use of fitbit charge 2, you miss important benefits and your health risks increase: Increased risk of heart disease by not improving blood circulation. Increased risk of developing high cholesterol. Increased body weight or body fat. Obesity is a risk factor for heart disease and can also be a culprit in other diseases. Increased inability to build and maintain healthy muscles, bones, and joints.
Argument strength	Logical arguments (LAG)	**Fitbit charge 2** collects information to the extent required to provide services via the Fitbit App according to the new Data Protection Act. Data is collected for the following purposes: To improve the functionality of the Fitbit App and website services and to process payments. To email you newsletters and marketing, as required. To transfer to a third party in the event of a merger or an acquisition.
	Illogical arguments (IAG)	**Fitbit charge 2** collects information to the extent required to provide services via the Fitbit App according to the new Data Protection Act. Data is collected for the following purposes: Comply with the new Privacy Policy. Collect data in order to provide services. The use of data according to the Privacy Policy.
	No arguments (NOG)	**Fitbit charge 2** collects information to the extent required to provide services via the Fitbit App according to the new Data Protection Act.